

**REMARKS**

Claims 73-78, 80-99, 102 and 103 stand in the present application, claims 75, 80, 83, 87, 88, 99, 102 and 103 having been amended. Reconsideration and favorable action is respectfully requested in view of the above amendments and the following remarks. Applicants note with appreciation the kindness and helpfulness provided by the Examiner at the interview on August 29, 2002.

In the Office Action, the Examiner has objected to the Abstract. As noted above, Applicants have corrected the deficiency noted by the Examiner in the Abstract and accordingly the Examiner's objections to the Abstract is believed to have been overcome.

The Examiner has also objected to claims 87-88 and rejected claims 75, 80, 83-97, 99 and 103-103 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. As noted above, Applicants have endeavored to correct all of the objections and § 112 deficiencies noted by the Examiner and accordingly, the Examiner's objections and rejections of the claims under § 112, second paragraph, are believed to have been overcome.

The Examiner has also rejected claims 73 under 35 U.S.C. § 102(b) as anticipated by Ichii et al., has rejected claims 74-76 and 97 under 35 U.S.C. § 103(a) as being unpatentable over Ichii et al., has rejected claims 77-99 and 102-103 under 35 U.S.C. § 103(a) as being unpatentable over Ichii et al. in view of Beauseigneur, has rejected claims 94, 96 and 98-99 under 35 U.S.C. § 103(a) as being unpatentable over Ichii in view of Knapton et al. and has rejected claim 95 under 35 U.S.C. § 103(a) as

being unpatentable over Ichii et al. in view of Abe et al. Applicants respectfully traverse all of the Examiner's § 102 and 103 rejections of the claims.

Applicants' invention is believed to be truly innovative and surprisingly contrary to the conventional knowledge, as will be described in detail below. In the prior art, a catalyst must be supported on a coating of  $\gamma$ -alumina particles or the like having a large surface area, formed on a ceramic support. The Examiner alleges that since Ichii '885 does not expressly mention such a coating, the disclosure of Ichii '885 discloses a ceramic support on which a catalyst is directly carried. Applicants respectfully submit that this is incorrect. Prior to Applicants' invention, all persons skilled in the art knew that it was necessary to apply a coating on a ceramic support before a catalyst is applied, and that it was also a common practice in this technical field to eliminate the description of the formation of a coating when specific coating information is not involved. Therefore, when references such as Ichii are read, persons skilled in the art know and understand that a coating must also be formed. As evidence of this fact, please see paragraphs 1-3 of the attached Rule 132 Declaration by one of the present inventors, Mr. Tanaka, a person skilled in the art.

Mr. Tanaka's Rule 132 declaration, at paragraphs 4-7, also proves that a catalyst is effective only when the particle size of the catalyst is in a range of 248 nm or smaller, practically 100 nm or smaller. Therefore, only a ceramic support having fine pores with an average pore size of 248 nm or smaller, practically 100 nm or smaller, can exhibit the capability of supporting an effective catalyst. The present invention resides in a catalyst-ceramic body comprising defects having a size of 0.1 to 100 nm or oxygen lattice defects (nano-order defects) where a catalyst is directly supported. This is

completely contradictory to the common knowledge, in which a catalyst is not directly supported on a ceramic body but is supported on a ceramic body using a coating of large surface area particles. The present inventors first discovered that a catalyst can be supported directly on a ceramic support without a coating.

The cited references do not disclose or even suggest the present invention at all. Ichii '885 discloses a low thermal expansion cordierite aggregate which consists mainly of cordierite crystals having a mean crystal diameter of at least 50  $\mu\text{m}$ . Beauseigneur discloses a thermal shock resistant washcoated substrate in which a buffer solution is introduced into the microcracks and micropores to form a gel at the interface between the buffer solution and the washcoat. Knapton discloses a catalyst comprising a substrate having deposited thereon a first coating containing a refractory metal oxide and having deposited upon the oxide one or more intermetallic compounds of the formula  $\text{AxBy}$ . Abe discloses a catalyst for exhaust gas purification comprising a heat resistant inorganic carrier and a catalyst layer. The catalyst layer comprises a catalyst composition containing at least one noble metal and active alumina, where the active alumina is formed using supercritical temperature and pressure.

Claim 73 was rejected as being anticipated by Ichii '885. No mention of a coating in Ichii does not mean that a coating is not necessary. Ichii does not evaluate the purification performance and therefore the method of supporting a catalyst is not described. Those of ordinary skill in the art would read and understand Ichii as requiring a general coating.

Claims 74 - 76 and 97 were rejected as being obvious in view of Ichii. The Examiner is of the opinion that since Ichii discloses a crystal diameter of less than 3  $\mu\text{m}$ ,

the distance between catalyst particles of less than 3  $\mu\text{m}$  is obvious. However, the crystal diameter of cordierite and the distance between catalyst particles have no relationship with each other and therefore it is impossible to anticipate the distance between catalyst particles from the crystal diameter of cordierite. Even if it is assumed that the distance between catalyst particles can be anticipated from the crystal diameter of cordierite, the crystal diameter of 3  $\mu\text{m}$  or less of Ichii does not result in the distance between catalyst particles of 0.1 to 100 nm of the present invention. Moreover, as described above, it is believed that a coating is applied to the ceramic carrier in Ichii.

Claims 77 - 93 were rejected as being obvious from Ichii in view of Beauseigneur. The Examiner is of the opinion that Ichii discloses a cordierite honeycomb with a lattice defect with oxygen vacancies and oxygen storing capability, a composition of more than 48 wt%, and a honeycomb catalyst carrier without a coating, heating to form microcracks, and reheating. However, Ichii does not disclose a cordierite honeycomb with a lattice defect with oxygen vacancies and oxygen storing capability, and a honeycomb catalyst carrier without a coating, heating to form microcracks, and reheating. The composition of more than 48 wt% is only an ideal composition of cordierite. Concerning the heating and reheating for forming microcracks, Ichii describes only that hysteresis in the thermal expansion property appears when microcracks are formed. As described above, a coating must be applied to the ceramic carrier in Ichii.

The Examiner mentions that Beauseigneur discloses ceria, transition metals and pore size of less than 5 microns. However, Beauseigneur does not describe that pores with a size of less than 5 microns can support a catalyst. The present invention

discloses that only fine pores with a size of 0.1 to 100 nm can support a catalyst. Pores on the order of 5 microns cannot support a catalyst (see the attached Tanaka Declaration). In any event, the pore size of less than 5 microns of Beauseigneur does not suggest that fine pores with a size of 0.1 to 100 nm can support a catalyst. Indeed, Beauseigneur and Sato use a coating, which precludes these references from even suggesting a ceramic-catalyst body in which a catalyst is supported directly on a ceramic body. The "50  $\mu\text{m}$ " appearing in the abstract and column 8, lines 52 - 55 of Ichii is the crystal diameter, not the pore size as the Examiner considers.

For claim 94, Knapton discloses CVD but it is used for forming a coating. For claim 96, the Examiner noted that inclusion of organic solvents having a higher surface tension than water is obvious, but a solvent having a lower surface tension than water is used in the present invention.

For claim 95, the Examiner is of the opinion that Abe discloses a supercritical state, but Abe uses a coating of active alumina and a supercritical state is not used to support a catalyst on a ceramic support.

Ichii intends to reduce defects and therefore cannot teach a ceramic support having fine pores with a size of 0.0 to 100 nm.

In view of the above, it is respectfully submitted that the present invention is not anticipated by or obvious from the cited references taken singly or in any combination.

Therefore, in view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all of claims 73-78, 80-99, 102 and 103, standing in the application, be allowed and that the case be passed to issue. If there are any other issues remaining which the Examiner believes could be resolved

KOIKE et al  
Serial No. 09/546,227


through either a supplemental response or an Examiner's amendment, the Examiner is respectfully requested to contact the undersigned at the local telephone exchange indicated below.

Attached hereto is a marked-up version of the changes made to the specification and claim(s) by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made.**"

Respectfully submitted,

NIXON & VANDERHYE P.C.

By:

  
25640  
for Chris Comuntzis  
Reg. No. 31,097

CC:lmr  
1100 North Glebe Road, 8th Floor  
Arlington, VA 22201-4714  
Telephone: (703) 816-4000  
Facsimile: (703) 816-4100

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE CLAIMS**

75. (Twice Amended) The catalyst-ceramic body according to claim 73, wherein an [said] average distance between particles of said catalyst [crystal] component is in a range of 0.1 to 100 nm.

80. (Twice Amended) A catalyst-ceramic body comprising a ceramic support comprising a honeycomb structure and having [comprising at least as a main component] a cordierite composition, wherein at least one of Si, Al and Mg elements constituting the cordierite composition being replaced by a metal having a catalyst activity.

83. (Twice Amended) The catalyst-ceramic body according to claim 80, wherein said metal having a catalyst activity includes at least one material selected from the group consisting of noble metals, V, Nb, Ta, Cr, Mo, W, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sn, and Pb.

87. (Twice Amended) A process for producing a catalyst-body, comprising:  
preparing cordierite materials comprising a [an] Si source, an Al source and a Mg source as well as a binder, some of said Si, Al and Mg sources being replaced by a noble metal-containing compound,

forming said cordierite materials into a honeycomb shape,

heating said honeycomb shape to remove said binder, and

firing said honeycomb shape in a reduced pressure atmosphere at a pressure of not higher than 4000 Pa, a reducing atmosphere, an oxygen-containing atmosphere or an oxygen-free atmosphere to form a catalyst-ceramic body comprising a ceramic support of a honeycomb structure comprising [at least as a main component of] a cordierite composition.

88. (Twice Amended) A process for producing a catalyst-ceramic body, comprising:

preparing cordierite materials comprising a [an] Si source, an Al source and a Mg source as well as a binder, some of said Si, Al and Mg sources being replaced by a noble metal-containing compound and a Ce-containing compound,

forming said cordierite materials into a honeycomb shape,

heating said honeycomb shape to remove said binder, and

firing said honeycomb shape in a reduced pressure atmosphere at a pressure of not higher than 4000 Pa, a reducing atmosphere, an oxygen-containing atmosphere or an oxygen-free atmosphere to form a catalyst-ceramic body comprising a ceramic support of a honeycomb structure comprising [at least as a main component of] a cordierite composition.

99. (Twice Amended) A process for producing the catalyst-ceramic body as set forth in claim 73, comprising depositing a catalyst component a plurality of times using the same or different catalyst compositions.



102. (Twice Amended) The catalyst-ceramic body according to claim 80, wherein said cordierite has a composition corresponding to a [theoretical] composition expressed by  $2\text{MgO} / 2 \cdot 2\text{Al}_2\text{O}_3 \cdot 5\text{SiO}_3$ .

103. (Twice Amended) The process for producing a catalyst-ceramic body according to claim 89, wherein said cordierite has a composition corresponding to a [theoretical] composition expressed by  $2\text{MgO} / 2 \cdot 2\text{Al}_2\text{O}_3 \cdot 5\text{SiO}_3$ .

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**ABSTRACT OF THE DISCLOSURE**

A ceramic support capable of supporting a catalyst comprising a ceramic body having fine pores with a diameter or width up to 1000 times the ion diameter of a catalyst component to be supported on the surface of the ceramic body, the number of the fine pores being not less than  $1 \times 10^{11}$  pores per liter, is produced by introducing oxygen [vacancies] vacancies or lattice defects in the cordierite crystal lattice or by applying a thermal shock to form fine cracks.